Art. IX.—*On the Relationship between "Pecten" asperrimus Lamarck and "Pecten" antiaustralis Tate, with a description of an Allied Fossil Form.*

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(With Plates II.-IV.)

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Introduction.

The specific distinctness or otherwise of *Chlamys antiaustralis* (Tate) and *C. asperrimus* (Lamarck) has been the subject of varying opinions. It therefore appeared desirable to examine, in conjunction with series of the Recent shells, the type of the fossil species and as many as possible of the fossil occurrences, one of which we consider to be a hitherto undescribed form.

Genus **Chlamys** (Bolten) Röding, 1798.

Chlamys asperrimus antiaustralis (Tate, 1886).

(Pl. II., Fig. 3; Pl. III., Figs. 6, 7; Pl. IV., Fig. 10*a,b*.)

Pecten asperrimus Lamarck, var. Tate, 1882, p. 34.

Pecten antiaustralis Tate, 1886, pp. 106-7, pl. ix., f. 7*a-c*. Harris, 1897, pp. 315-6. Tate, 1899, p. 269.

Historical Account.—Tate in 1886 gave specific rank to fossil shells from the upper beds (Upper Aldingan=Kalimnan) at Aldinga, South Australia, which he had previously recorded as *Pecten asperrimus*, var. He admitted the very close alliance with the Recent shells listed by him as *P. australis* Sowerby, and thought by him to be probably identical with *P. asperrimus* Lamarck, an identification now generally accepted. He cited as distinctive characters "the *lamelliform* ornamentation of the convex ribs and riblets, whilst in *P. australis* they are angular, and beset with distant scaly serratures or spinous scales; moreover, the valves, especially the left valve, is more convex". He further stated (1886, p. 107), "The young of the two species are much alike, having simple ribs, developing with age a riblet on each side. Rarely does *P. australis* acquire more, but *P. antiaustralis* does so as a rule, and aged examples exhibit two or three on each flank, and often one in the furrow, whilst the concentric lamellæ are continuous across the furrows. The ears of the fossil species are larger, and the shell attains to greater dimensions. *P. antiaustralis*, however, exhibits variations in the degree of convexity of the valves and ribs, whilst *P. australis*—the commonest shell on the South Australian coast—is true to its type."

Observations on the Holotype.—The type of *Pecten antiaustralis* Tate, from the University of Adelaide, has been compared by us with a series of fossil topotypes as well as with a long series of Recent *Chlamys asperrimus* (Lamarck) dredged in Westernport, Victoria (J. H. G. Coll.).

While some fossil examples (Pl. II., Fig. 4) appear to us to be inseparable from the Recent *Chlamys asperrimus, s. str.*, they intergrade with the fossil holotype (Pl. II., Fig. 3; Pl. III., Fig. 6), which seems to be an extreme form. Of the distinctive characters relied upon by Tate, and above quoted, we are unable to perceive any difference in convexity of the valves, number of lateral riblets, or size of the ears. We admit the greater width of the ribs (Pl. IV., Figs. 10*a,b*) as compared with most Recent examples (Pl. IV., Figs. 11*a,b*), though some of them approach it somewhat in this regard, and the apparently more angular character of the ribs of the latter is due solely to their narrowness. Actually they are equally rounded. Owing to the wider ribs of the fossil holotype the ornament in the adult stage is lamelliform (Pl. IV., Fig. 10*b*), but in the juvenile stages the scales where preserved are more pointed, owing to the narrower base from which they spring. Correspondingly in Recent shells there is a tendency for the spinous scales to become more lamelliform towards the ventral margin. Their spacing varies during growth of the shell, but is in general more close in the fossil holotype.

The lateral riblets in Recent shells are at least as numerous as in Tate's type specimen, and his observations in this regard were apparently due to comparison with relatively young examples of the Recent species, which, as seen in the illustrations, attains at least an equal size in the gerontic stage.

Apart from the lamelliform character of the mature ornament, the chief distinctive feature of the fossil holotype, although not mentioned by Tate, lies in the finer and more numerous radial ribs of the anterior ear of the right valve, which, like the corresponding ear of the left valve, is imperfect. That this feature is a variable one is indicated by our figures of a fossil topotype with coarse ribbing of this ear (Pl. III., Fig. 7), and of a Recent shell with relatively fine auricular ribs (Pl. II., Fig. 2.).

Dimensions of Holotype.—Width (ant.-post.), 68·2 mm. Height (umbono-ventral), 67·9 mm. Thickness of paired valves, 26·3 mm. Tate's dimensions, 58 × 58 × 25 mm., are evidently erroneous, as the specimen is marked as the figured one.

Conclusions.—Although we reject the majority of Tate's criteria for distinction between his species and the living form, we recognise variation from the latter, notably in regard to the lamelliform character of the closely spaced scales on the ribs in the gerontic stage. It is apparent that Tate has selected an extreme form as holotype, and the presence, in a series of fossil topotypes, of forms annectent in characters with a shell (Pl. II., Fig. 4) identified by us with *Chlamys asperrimus, sensu stricto,*

impels us to accord his species only subspecific rank as C. *asperrimus antiaustralis.*

In the case of juvenile and of somewhat worn specimens, it is very difficult to make subspecific distinctions, and a reference to *Chlamys asperrimus, sensu lato,* is often all that is possible.

CHLAMYS ASPERRIMUS ASPERRIMUS (Lamarck, 1819).

(Pl. II., Figs. 1, 2, 4; Pl. III., Fig. 5; Pl. IV., Figs. 11*a,b,* 12.).

Pecten asperrimus Lamarck, 1819, p. 174. Delessert, 1841, pl. xv., f. 1*a,b.* Sowerby, 1842, p. 75, pl. xvii., f. 156-8. Reeve, 1853, pl. xx., f. 75.

Pecten australis Sowerby, 1842, p. 76, pl. xix., f. 210. 220. Reeve, 1853, pl. xxv., f. 103*a,b.*

Chlamys asperrimus (Lamarck). Pritchard and Gatliff, 1904, p. 264.

Observations on the Fossil Plesiotype.—The right valve here figured (Pl. II., Fig. 4; Pl. IV., Fig. 12), from the same locality and horizon as the holotype of *antiaustralis* Tate, appears to us to agree in all essential characters with Recent *asperrimus, s. str.* We have enumerated the points of distinction from *antiaustralis* in dealing with that subspecies, and have indicated the occurrence of intermediate forms.

Dimensions of Fossil Plesiotype.—Width, (ant.-post.) 66·8 mm. Height, 67·1 mm. Thickness of paired valves, 25·2 mm.

Dimensions of Recent Plesiotypes.—Larger: Width, 68·0 mm. Height, 67·3 mm. Thickness of paired valves, 27·1 mm. Smaller: 60·6 × 61·1 × 21·9 mm.

CHLAMYS ASPERRIMUS DENNANTI, subsp. nov.

(Pl. III., Figs. 8, 9; Pl. IV., Fig. 13*a,b.*)

Pecten asperrimus Lamarck: Dennant, 1887, p. 236 (list name). Harris, 1897, p. 314. (*Non P. asperrimus* Lamarck, *s. str.*)

Description of Holotype.—Right valve, suborbicular, slightly oblique, gently convex. Umbonal angle 79°, acute; anterior margin slightly concave, meeting the antero-ventral edge with a distinct angulation; the ventral margin almost circular, passing posteriorly into the concave post-umbonal margin.

Surface somewhat evenly convex, slightly depressed ventrally, bearing 27 prominent radiating ribs with two minor ribs anteriorly. Interspaces nearly filled with minor radial riblets, up to three on either flank of each main rib, between which centre of interspace is concave and transversely ornamented by close, irregularly spaced growth lines; about 15 riblets posterior to the last main rib. In places the interspaces show the very fine radial ornament seen in fossil and recent examples of *asperrimus, sensu lato.* Major ribs prominent, evenly convex, bearing numerous trans-

verse lamellate scales, irregularly spaced, about 9-10 in 5 mm., convex towards umbo. Interstitial riblets ornamented with closely set spinose scales, about 14-17 in 5 mm. Ears prominent, unequal, bearing numerous radial ribs carrying closely spaced erect scales. Anterior ear descending from dorsal margin in a curve to the prominent byssal sinus, bearing 9 prominent ribs with an intercalated riblet between each of the lower pairs towards their margins; ctenolium present. Left ear obliquely truncated posteriorly, with about 21 radii alternating in size, less prominent than on right ear.

Dimensions of Holotype.—Width (ant.-post.), 53·2 mm. Height, 58·8 mm. Thickness of valve, 11 mm.

Description of Paratype (Pl. III., Fig. 9).—Left valve slightly smaller than holotype (not a counterpart), of similar outline, but somewhat narrower and slightly more convex. Radial ribs 23, with similar ornament and interstitial riblets.

Dimensions of Paratype.—48·5 × 57·0 × 11 mm.

Observations.—The present subspecies differs from *asperrimus, s. str.*, and *antiaustralis* in the greater narrowness of the shell, the outline of which resembles *Chlamys funebris* (Reeve) of the West Australian coast. The latter is, however, slightly more orbicular than *dennanti* and the ribs are broader and heavier, and lack the numerous interstitial riblets of the fossil form. The principal ribs in *dennanti* are rather narrower than in *asperrimus, s. str.*, and are relatively more prominent.

Fossil Records of Pecten asperrimus.

In addition to Tate's original usage of *asperrimus* var. for the Kalimnan fossils later called *antiaustralis*, the above name was used by Dennant (1887, p. 236) and Harris (1897, p. 314) for Werrikooian fossils herein named *dennanti*, n. subsp. We have, however, restored *asperrimus*, s. str., to the Kalimnan record as an associate of the subspecies *antiaustralis*.

Tenison Woods (1879, p. 56) states of *Pecten asperrimus*, "Fossil specimens are very common in the pliocene rocks of Government House quarry, Adelaide," which refers probably to the Kalimnan horizon, but whether the name is used in the restricted sense of the present paper is unknown to us.

Recent Records of Pecten antiaustralis.

Hedley (1911, p. 96) has erroneously recorded as *Chlamys antiaustralis* shells from 100 fathoms off Cape Pillar, Tasmania, which have since been described as *Chlamys instar* by Iredale (1925, p. 251, pl. xli., figs. 5-7), while other specimens recorded by Hedley (loc. cit.) from a similar depth off Wollongong, N.S.W., were referred by Iredale to a second new species, *Chlamys famigerator* (1925, p. 252, pl. xli., figs. 1, 2), to which

he suggests perhaps may belong Hedley's deepwater shells from off Cape Wiles, South Australia.

We are not aware of any Recent shells which are referable to *antiaustralis*, s. str.

Summary.

1. The fossil pelecypod *Pecten antiaustralis* Tate, described from the Upper Beds (Kalimnan=Lower Pliocene?) at Aldinga, South Australia, is considered to be a subspecies of the Recent *Pecten asperrimus* Lamarck, and should bear the name *Chlamys asperrimus antiaustralis* (Tate). It is accompanied at the type locality and horizon by shells identified by us as *Chlamys asperrimus* (Lamarck), *s. str.*

2. The shells recorded as *Pecten asperrimus* from the Werrikooian (Upper Pliocene or Pleistocene?) beds of the Glenelg River, Western Victoria, are described as *Chlamys asperrimus dennanti*, subsp. nov.

3. The subspecies *antiaustralis* differs from *asperrimus*, s. str., chiefly in the wider ribs and lamellíform character of the mature ornament. In *dennanti* the ribs are even narrower and more prominent than in the latter, while the shell is narrower than in the other two subspecies.

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Explanation of Plates.

The figures in Plates II. and III. are approximately natural size; those in Plate IV. are enlarged about 2½ times linear.

Plate II.

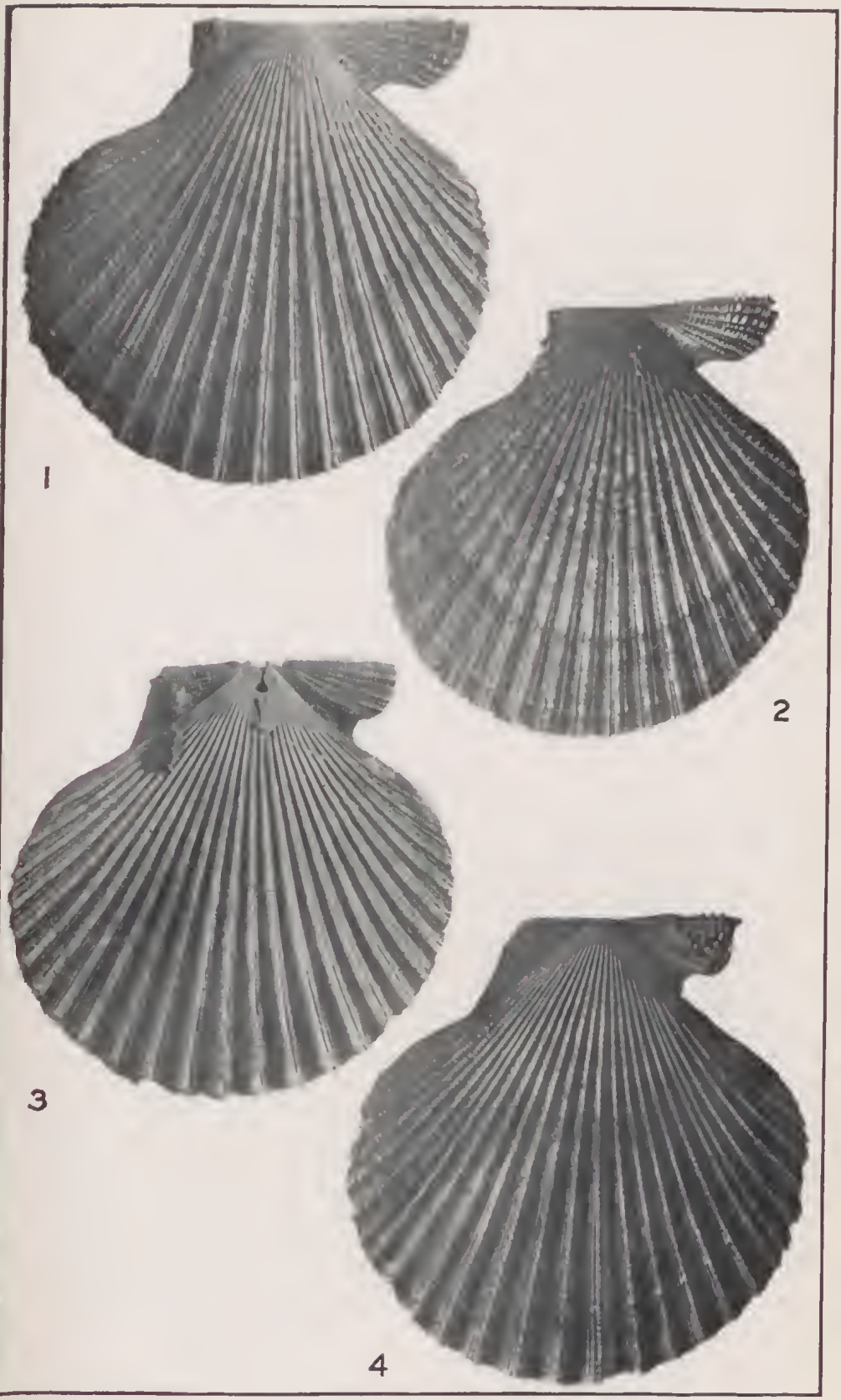
Figs. 1, 2.—*Chlamys asperrimus asperrimus* (Lamarck). Recent. Westernport, Vic. Plesiotypes, right valves, showing coarse and fine ribbing of anterior ear respectively. Ex Gatliff Coll.; pres. to Melbourne University Geol. Dept., Reg. Nos. 989 and 991.

Fig. 3.—*C. asperrimus antiaustralis* (Tate). Tertiary (Kalimnan). Aldinga, S.A., upper beds. Holotype of *Pecten antiaustralis* Tate, right valve. Tate Coll., Adelaide University Geol. Dept.

Fig. 4.—*C. asperrimus asperrimus* (Lamarck). Tertiary (Kalimnan). Aldinga, S.A., upper beds. Plesiotype, right valve. Kimber Coll.

Plate III.

Fig. 5.—*Chlamys asperrimus asperrimus* (Lamarck). Recent. Plesiotype, left valve, counterpart of Fig. 1. Ex Gatliff Coll.; pres. to Melb. Univ. Geol. Dept., Reg. No. 990.



J. Wilson-Smith photo.

Chlamys asperrimus. Recent and Fossil.